

## CLAIMS

- 1 A method of laser micro-machining, by means of a laser, a work piece of the type described characterised by the steps of: locating the workpiece on a carrier forming a part of a transport system whereby the carrier can be displaced along a path parallel to an X-axis of the workpiece, a Y-axis lying transverse the path, and a Z-axis lying transverse the path; focussing an image generated by means of an output beam from the laser at a working datum position defined relative to the path which path is established by means of the transport system to traverse the first datum position; a plane defined by the X- and Y- axis lying substantially perpendicular to the output beam; and displacing the workpiece along the path by way of the transport system so as to enable the work-piece to be subject to micro-machining by way of the laser characterised by the steps of:
  - maintaining distance between the datum position and a current first surface position of the workpiece in the vicinity of the datum position ; and
  - varying the working datum position to accord with local variations in thickness of the workpiece so that the working datum position is maintained at a fixed distance relative to a surface of the workpiece.
- 2 A method as claimed in Claim 1 characterised in that the step of varying the working datum position is achieved by displacing the focussing or imaging lens relative to the workpiece.
- 3 A method as claimed in Claim 1 characterised in that the step of varying the working datum position is achieved by displacing the work-piece relative to the focussing or imaging lens..
- 4 A method as claimed in Claim 1 characterised in that the sensing step is undertaken by means of a distance sensing device comprising a body member riding on a fluid cushion on a first surface of the workpiece the fluid cushion

being established by a flow of fluid fed from the body member so as to maintain the body member at a predetermined distance from first surface; and in the event the body member is displaced from a current position of the body member due to a variation in thickness of the workpiece any change in position of the body member perpendicular to the first surface is used to modify position of the lens to cause a corresponding change in the current datum position to restore the working datum position to its fixed distance relative to the first surface of the workpiece.

- 5 A method as claimed in Claim 3 characterised in that the body member located relative to a first side of the workpiece and a further body member is provided located relative to a second side of the workpiece on the opposite side of the workpiece to the first workpiece and the further body member serves to urge the workpiece towards the body member when a local thickness of the workpiece is reduced.
- 6 A method as claimed in any preceding claim characterised in that locating the workpiece on the carrier provides for the plane of the workpiece defined by the X-axis and the Y-axis to be vertical or at some other angle to the horizontal.
- 7 Apparatus for laser micro-machining, by means of a laser, a work piece of the type described characterised by:  
a carrier forming a part of a transport system whereby the carrier can be displaced along a path parallel to an X-axis of the workpiece, a Y-axis lying transverse the path, and a Z-axis lying transverse the path; means whereby an output beam from a laser can be focussed or imaged at a predetermined working datum defined relative to the path which path is established by means of the transport system to traverse the first datum position; a plane defined by the X- and Y- axis lying substantially perpendicular to the output beam; drive means for causing the workpiece to be displaced along the path by way of the

transport system so as to enable the work-piece to be subject at the datum position to micro-machining by way of the laser characterised by the steps of maintaining means for regulating distance between a current working datum position and a current first surface position of the workpiece in the vicinity of the datum position ; and

focus adjusting means enabling the working datum position to accord with local variations in thickness of the workpiece so that the working datum position is maintained at a fixed distance relative to a surface of the workpiece and/or

providing a carrier and transport system enabling the workpiece to be displaced along the path with the plane of the workpiece defined by the X-axis and the Y-axis either vertical or at some other angle to the horizontal.

- 8 Apparatus as claimed in Claim 7 characterised in that the means for focus adjusting serves to displace the focussing or imaging lens relative to the workpiece.
- 9 Apparatus as claimed in Claim 7 characterised in that the maintaining means serves to displace the work-piece relative to the focussed beam or image.
- 10 Apparatus as claimed in Claim 7 characterised by a distance sensing device comprising a body member riding on a fluid cushion on a first surface of the workpiece the fluid cushion being established by a flow of fluid fed from the body member so as to maintain the body member at a predetermined distance from first surface; and in the event the body member is displaced from a current position of the body member due to a variation in thickness of the workpiece any change in position of the body member perpendicular to the first surface is used to modify the focussing or imaging forming step to cause a corresponding change in the current datum position to restore the working datum position to its fixed distance relative to the first surface of the workpiece.

- 11 Apparatus as claimed in Claim 7 characterised in that the body member located relative to a first side of the workpiece and a further fluid emitting body member is provided located relative to a second side of the workpiece on the opposite side of the work-piece and the path to the first workpiece and fluid output from the further body member serves to urge the workpiece towards the body member when a local thickness of the workpiece is reduced.
- 12 A product in the form of a substrate characterised in that it is micro-machined by the method of one or more of Claims 1 to 6.
- 13 A product in the form of a substrate characterised in that it is micro-machined by way of apparatus of one or more of claims 7 to 11.